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ABSTRACT

The subject mortality problems of an experimental design which covers the period of student recruitment through posttesting over a 13-month period, is detailed in this study. Out of an effective applicant pool of 72 students randomly assigned to experimental and control groups, only 38 students remained at the end of the study with complete test data. Over one-fourth of the sample dropped out of school, with another 20 percent not tested due to mobility or unavailability. The ways attrition occurred, attrition time points, categories of attrition identification and the effects of attrition are discussed in light of a detailed analysis of student attrition. Data are analyzed for mortality effects according to a design presented by Jurs (1970). Methods of controlling or reducing attrition are discussed and suggestions for future study are presented. (Author/DEP)

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ATTRITION PROBLEMS IN AN EXPERIENCE-BASED CAREER EDUCATION PROJECT[1]

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Between 1972 and the present, the Northwest Regional Educational Laboratory (NWREL) has been developing and evaluating an Experience-Based Career Education Program (EBCE). Funded by the National Institute of Education, EBCE is a comprehensive, individualized career education program that integrates a high school student's learning in the areas of Basic Skills, Life Skills and Career Development through work and learning experiences in the community.[3] This document concentrates on the problems of differential attrition between experimental and control groups of the EBCE demonstration project in Tigard, Oregon, called Community Experiences for Career Education $(CE)_2$.

Background

Now in its fourth year of operation, $(CE)_2$ is operated by a non-profit community corporation at NWREL's "parent site" for research and demonstration of EBCE. During the first three years of operation $(CE)_2$ enrolled 25, 50 and 60 high school juniors and seniors, respectively, with a professional staff of seven members who have split their time between program development and operations. Over 120 employers and community people provide learning experiences for $(CE)_2$ students in the community.

During the early phases of development, the evaluation unit concentrated on providing formative evaluation feedback to the developers. As the program stabilized, the emphasis shifted toward summative evaluation with progressively less attention to formative evaluation. In the first year of operation, the evaluation report concentrated on formative questions (Herron, 1973). During the past two years, the emphasis has shifted to the

evaluation of summative outcomes (Owens, Herron and Fehrenbacher, 1974; Owens, Haenn and Fehrenbacher, 1975).

As the evaluation emphasis shifted, the evaluation design became more sophisticated. The One-Shot Case Study and One-Group Pretest-Posttest pre-experimental designs (Campbell and Stanley, 1973) were employed during the 1972-73 school year. In the next year, the Nonequivalent Control Group quasi-experimental design was used with three different but unmatched control groups. Then, during school year 74-75, a Pretest-Posttest Comparison Group true experimental design was used as applicants to the program were randomly assigned to the $(CE)_2$ experimental group (E) or to remain at the high school as a true control group (TC). This paper concentrates on the differential attrition between these two groups.

Student Selection

From a student recruitment drive, there were 87 applicants to the $(CE)_2$ program in the spring of the preceding school year. Three of these applicants were from outside the school district and were not included in the random selection pool. Twelve of these students were considered to be highly motivated according to ratings by their high school counselors. These 12 applicants were guaranteed admission to the $(CE)_2$ program to counterbalance a disporportionate number of students returning to $(CE)_2$ from the prior year who were judged to be low in motivation. The 12 students guaranteed admission into the program were also dropped from the random selection pool.

The remaining 72 applicants became the applicant pool from which random selection into the program was to be made. These students were

arranged alphabetically and numbered sequentially from 1 through 72. Using a table of random numbers (Fisher and Yates, 1943), as each student's number was encountered, a sequential entry number was assigned. Students with entry numbers 1 through 30 were then extended an invitation to join $(CE)_2$. The composition of these students and the remaining group is shown in Table 1 below.

Table 1. Sex and Grade Composition of the Experimental and Control Groups After Random Selection (April 1974)

	Invited to Join $(CE)_2$			Not Invited to Join $(CE)_2$		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	7 (32)*	12 (43)	19 (38)	15 (68)	16 (57)	31 (62)
Seniors	7 (54)	4 (44)	11 (50)	6 (46)	5 (56)	11 (50)
	14 (40)	16 (43)	30 (42)	21 (60)	21 (57)	42 (58)

*Number in parentheses is the percent of students out of total available from that cell for random selection, e.g., there were 22 total junior males so that $(CE)_2$ percentage was 32 percent (7 out of 22) and the non-$(CE)_2$ percentage was 68 percent (15 out of 22).

Since $(CE)_2$ randomly selected about 42 percent of the eligible students (30 out of 72), this proportion could be expected to be approximated in each cell and for each row and column total. The above table shows that sex was randomly distributed between the two groups, but that the $(CE)_2$ group contained an oversampling of seniors, especially senior males, and an undersampling of junior males.

Of the 30 students invited to join $(CE)_2$, three students (a junior male, junior female and a senior male) declined the invitation and were returned to the high school control group. The next three students in line in the applicant pool (two junior females and one male) were extended

an invitation, but one of the junior females had already decided to drop out of school. In addition, three other high school control group students dropped out of school (two junior females and one senior female) and one student moved from the district (a junior male). Therefore, at the end of the school year prior to the experimental year, the composition of the groups was as shown below in Table 2.

Table 2. Sex and Grade Composition of the Experimental and Control Groups as of May 1974

	Prospective $(CE)_2$ Students			Prospective Control Group		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	7 (33)	12 (46)	19 (40)	14 (67)	14 (54)	28 (60)
Seniors	6 (46)	4 (50)	10 (48)	7 (54)	4 (50)	11 (52)
	13 (37)	16 (48)	29 (43)	21 (63)	18 (52)	39 (57)

The $(CE)_2$ students now comprised 43 percent (29 out of 68 students) of the remaining applicant pool. This group still contained a disproportionately low number of male juniors.

During the summer and before the end of the first two weeks of the program, many other changes occurred in the $(CE)_2$ group. One student dropped out of school (a junior female), three students returned to the high school from the experimental group (a junior female and male and a senior male) and one student moved out of the district (a junior female). The high school control group also had some attrition. Five students dropped out of school (three junior and two senior females) and three students moved out of the district (two junior males and one female). In addition, the $(CE)_2$ dropouts were replaced with eight students from the high school control group in

order of their assigned admission numbers (five junior males and one female plus two senior males).

Table 3 presents the composition of the two groups by pretest time:

Table 3. Sex and Grade Composition of the Experimental and Control Groups at Pretest Time (September 30, 1974)

	$(CE)_2$ Students			Control Group Students		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	11 (58)	10 (50)	21 (54)	8 (42)	10 (50)	18 (46)
Seniors	7 (54)	4 (67)	11 (58)	6 (46)	2 (33)	8 (42)
	18 (56)	14 (54)	32 (55)	14 (44)	12 (46)	26 (45)

The $(CE)_2$ group was now larger than the high school control group and comprised 55 percent of the remaining applicant pool. The two groups were roughly similar in sex and grade composition at this point. However, the control group now contained two students who had declined entry into the $(CE)_2$ program (a junior and a senior male) plus three accepted applicants who later changed their minds and decided to return to the high school (a junior male and female and a senior male).

Within the next month both of the control group students who had declined program entry dropped out of school and two $(CE)_2$ students left the program (a senior male dropped out of school and a junior male moved out of the district). One additional control group student (a junior female) was admitted into the $(CE)_2$ program after the six applicants ahead of her declined an invitation. However, since several weeks had already elapsed in the school year and it was felt that his was the primary reason these applicants declined the invitiation to join, they were continued as comparison group students. Six weeks into the school year

18 of the original 72 applicants had dropped from school or moved out of the district and the composition of the groups was as shown in Table 4.

Table 4. Sex and Grade Composition of the Experimental and Control Groups After Pretesting (October 15, 1974)

	$(CE)_2$ Students			Control Group Students		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	10 (59)	11 (55)	21 (57)	7 (41)	9 (45)	16 (43)
Seniors	6 (55)	4 (67)	10 (59)	5 (45)	2 (33)	7 (41)
	16 (57)	15 (58)	31 (57)	12 (43)	11 (42)	23 (43)

These two groups were extremely similar in sex and grade composition. As can be seen in the table below, these groups were also very similar in pretest scores on the Comprehensive Test of Basic Skills (CTBS). In each case, the one or two students who returned to the high school before pretesting help to make the control group more similar to the experimental group. Note that three control group students (a senior female and a junior male from the True Control Group plus a senior male who had returned to the high school from the $(CE)_2$ program) were not pretested even after three contacts had been made and the students had been told they would be paid for their time. These students were also dropped from the control group for lack of complete data.

Table 5. CTBS Expanded Standard Score Means (Standard Deviations) for the Experimental and Control Groups at Pretest

		CTBS Pretest Scores		
	N	Reading Comprehension	Arithmetic Concepts	Arithmetic Applications
Experimental $(CE)_2$ Students	31	570.9 (86.3)	541.5 (77.5)	551.8 (102.5)
All Control Students	20*	547.2 (111.0)	546.5 (74.6)	559.4 (79.2)
True Control Students	18	543.7 (113.1)	545.9 (78.5)	560.8 (83.3)
Students Returning to H.S.	2*	611.0 (-)	552.0 (31.1)	547.0 (28.3)

*One student did not take the reading comprehension subtest.

By the end of the first semester, the experimental group remained unchanged. However, seven additional students were lost from the control group. Three students moved out of the district (a senior male, a junior female and a senior female who was not pretested) and four students dropped out of school (two junior males and one female plus one senior male). One of these drops (a junior male) was an original $(CE)_2$ student who previously had decided to return to the high school in September. Therefore, only halfway into the program year only 13 students remained in the control group out of the original 42 students. Two additional students (a junior male and a senior male who returned to the high school within three weeks after accepting entry into the $(CE)_2$ program) were still in the high school control group but had not been pretested. The composition of the group available for posttesting at this point is shown below in Table 6.

Table 6. Sex and Grade Composition of the Experimental and Control Group at Midyear (January 15, 1976)

	$(CE)_2$ Students			Control Group Students		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	10 (71)	11 (61)	21 (66)	4 (29)	7 (39)	11 (34)
Seniors	6 (75)	4 (80)	10 (77)	2 (25)	1 (20)	3 (23)
	16 (73)	15 (65)	31 (69)	6 (27)	8 (35)	14 (31)

The two groups at this point were still somewhat similar. To further compound the attrition problem, two additional control group students were admitted into the $(CE)_2$ program in March. These students (a junior and a senior female) would have dropped out of high school had they not been admitted to the $(CE)_2$ program and were no longer considered to be in either the experimental or control group.

Before the end of the school year one student (a junior female) was dropped from the $(CE)_2$ program and another student was not available for posttesting (also a junior female). In addition, three control group students (a junior male and female and a senior male) did not take the posttest--even though they were to be paid for their testing time after school. The number of subjects in each group who received both the pretest and posttest is shown in Table 7.

Table 7. Sex and Grade Composition of the Experimental and Control Groups After Posttesting (May 30, 1976)

	$(CE)_2$ Students			Control Group Students		
Grade/Sex	Male	Female	Totals	Male	Female	Totals
Juniors	10 (77)	9 (64)	19 (70)	3 (23)	5 (36)	8 (30)
Seniors	6 (86)	4 (100)	10 (91)	1 (14)	0 (0)	1 (9)
	16 (80)	13 (72)	29 (76)	4 (20)	5 (28)	9 (24)

Out of an original sampling group of 72 students, attrition accounted for a mortality rate of 47 percent. Approximately only half of the original sampling group remained with complete testing data. The causes of this attrition are enumerated in Table 8. Over half of the attrition was caused by students dropping out of school to go to work, to enlist in the military, to get married, to get a G.E.D., or because of pregnancy. Another quarter of the mortality was due to mobility when the students moved out of the school district. One out of four of the original applicants later dropped out of school, while one out of eight moved out of the district.

Table 8. Causes of Attrition

	Number	Percent of Dropouts	Percent of Total Sample
Dropped out of school (work, GED, enlistment, etc.)	19	55.9	26.4
Moved out of the district	9	26.5	12.5
Incomplete test data	6	17.6	8.3
	34	100.0	47.2

As Table 9 shows, more seniors than juniors dropped out of school. However, it was not expected that more females than males would drop out.

Table 9. Student Applicants who Dropped out of High School by Sex and Grade

	Male	Female	Total
Juniors	3 (14)*	9 (32)	12 (24)
Seniors	3 (23)	4 (44)	7 (32)
Totals	6 (17)	13 (35)	19 (26)

*Percentage of students out of the total number of students in the applicant pool for each category

High school records of the junior class were reviewed to see if these dropout rates were typical. In September 1974, there were 374 entering juniors. During the course of the school year 74 new juniors moved into the district, 21 juniors moved out of the district and 90 juniors dropped out of school. By June 1975, this was a net loss of only 37 students, but showed a mortality rate of almost 30 percent which included a dropout rate of 24 percent. This is the same dropout rate as the experimental and control students over a 13-month period. This attrition rate also parallels the national average of 23 percent which has "remained almost constant . . . since 1964." (Education U.S.A., 1976) The percentage of junior applicants

who moved out of the district was higher than junior class members as a whole (13 percent versus 6 percent), but this was also over a 13-month period including a summer (April 1974 through May 1975) versus an 8-month school year.

The $(CE)_2$ program lost only two students after the first 6 weeks in the program (one dropped out and one was unavailable for posttesting) while the control group at the high school lost 14 students (two were not pretested, three were not posttested, six dropped out of high school and three moved out of the district). The pre-post differences in sex and grade composition can be seen by comparing Tables 4 and 7. The mortality rate of 51 percent for the control group affected each of the sex and grade categories to a major degree. The slight mortality of 6 percent for the experimental group only affected the junior female category. The differences in basic skill ability are shown in Table 10 for students who stayed in the program or school and those who moved, dropped out or were untested.

Table 10. Pretest CTBS Expanded Student Score Means (Standard Deviations) for Experimental and Control Group Stayins and Dropouts

		CTBS Pretest Scores		
	N	Reading Comprehension	Arithmetic Concepts	Applications
Pretest Experimental $(CE)_2$ Students	31	570.9 (86.3)	541.5 (77.5)	551.8 (102.5)
Posttest Experimental $(CE)_2$ Stayins	29	568.4 (88.6)	558.3 (95.8)	543.9 (79.4)
Posttest Experimental Dropouts	2	606.5 (30.4)	506.0 (33.9)	512.5 (9.2)
Pretest Control Students	20*	547.2 (111.0)	546.5 (74.6)	559.4 (79.2)
Posttest Control Stayins	9	518.2 (115.8)	534.8 (89.0)	528.2 (57.9)
Posttest Control Dropouts	11*	573.3 (105.6)	556.1 (63.4)	585.0 (87.3)

*One student did not take the reading comprehension subtest.

These data were analyzed by Multivariate analysis according to the design for analysis of mortality as presented by Jurs (1970). As Table 11 shows, the difference between dropouts and students who stayed in the experimental and control groups (G) was not of sufficient magnitude to be significant. Therefore, the attrition can be considered to be random within groups, the external validity is not threatened and the results can be generalized to the population originally sampled. There is also no significant difference of dropouts across treatment groups (T x G interaction). Thus, the internal validity is not threatened. The nonsignificant treatment effect demonstrates that the subjects were randomly distributed between treatment groups.

Table 11. Analysis of Differences Between Treatments (Experimental vs. Control) and Between Groups (Dropouts vs. Stayins) on the Comprehensive Test of Basic Skills Pretest

		Reading Comp.		Arith. Concepts		Arith. Applic.		Multivariate	
	df	F	p<	F	p<	F	p<	F	p<
Between Treatments (T)	1	2.02	.17	< 1	NS	< 1	NS	1.21	.32
Between Groups (G)	1	< 1	NS	< 1	.15	2.14	.15	2.04	.12
Treatments by Groups Interaction (TxG)	1	< 1	NS	< 1	.17	1.98	.17	< 1	NS
Within TG	46								

Tests were also run on the significance of difference between dropouts and stayins for each group on the results of the Psychosocial Maturity Scale. the Self-Directed Search and a NWREL-developed EBCE Semantic Differential. In no case did the multivariate F exceed a value of two Between Groups (G). Therefore, there appear to be no significant differences between the dropouts

and stayins within the experimental and control groups in the areas of basic skills, life skills or career skills. However, there was a significant groups by treatment interaction effect on the semantic differential concept of "Work," with the concept of "Adults" and the Psychosocial Maturity Scale Work subscale approaching significance. The overall multivariate F ratio for the groups by treatment interaction across all basic skills, life skills and career skills variables also approached significance ($F = 1.82$, $p < .08$). Therefore, pretest scores were used as covariates in the final analysis.

Discussion

Several ground rules were established before the project began to reduce the effects of attrition. First, no control students were to be admitted into the $(CE)_2$ program as replacements after the fourth week of school. There were two exceptions to this rule in March because two control students would have dropped out of high school had they not been accepted into the program. Both of these students were excluded from any analyses.

Secondly, control group students were paid for their after-school participation since they had no real incentive or compulsion to become involved in the testing program. Even though these students were to receive $7.00 for taking the pretest battery, three students did not complete the testing. Because of further attrition during the school year, the posttest remuneration was raised to $10.00. However, three additional students did not appear for either of the posttesting sessions.

Finally, multiple test sessions and make-up testing was provided to minimize the effects of "test-skipping." Only one available experimental student was not tested and only because of an extended hospitalization at posttest time.

It is interesting to look at the project with hindsight based on our findings. With our applicant group of 72 students, we did foresee the problem of differential attrition and attempted to eliminate it or control it where possible. However, we did not even roughly estimate a mortality rate of the magnitude encountered. Almost one out of every two students was lost from the experiment between application and posttest time. Over half of the attrition was caused by students dropping out of school to go to work, to enlist in the military, to get married, to get a G.E.D., because of pregnancy or for other reasons. Another quarter of the mortality was due to mobility when the students moved out of the school district. One out of four of the original applicants later dropped out of school, while one our of eight moved out of the district. In order to have a final sample size of thirty students in each of the experimental and control groups with these rates of attrition, the original applicant pool would have had to have been at least 114 students, almost 60 percent larger than the existing applicant pool.

Since the applicant pool was fixed and the desired sample sizes of a minimum of thirty students per group were known, we would not have attempted this experimental design with this applicant pool and such a high rate of mortality. As our later examination of records illustrated, this mortality was not unusual for this school district or the nation.

It is suggested that, unless the experiment can absorb a high degree of student attrition, previous student attrition of the grade levels under study be explored in detail. In addition, one should allow for at least a 10 percent mortality rate just due to unavailability of subjects for testing. This percentage should be even higher for multiple pretest or

posttest sessions. These considerations hold even if precautions to reduce attrition, such as those already enumerated, are taken. Finally, this study illustrates some of the attrition problems of extending an experimental period over a summer period, even if only for student recruitment.

Summary

This study details the subject mortality problems of an experimental design which covers the period of student recruitment through posttesting over a 13-month period. Out of an effective applicant pool of 72 students randomly assigned to experimental and control groups, only 38 students remained at the end of the study with complete test data. Over one-fourth of the sample dropped out of school, with another 20 percent not tested due to mobility or unavailability.

The ways attrition occurred, attrition time points, categories of attrition identification and the effects of attrition are discussed in light of a detailed analysis of student attrition. Data are analyzed for mortality effects according to a design presented by Jurs (1970). Methods of controlling or reducing attrition are discussed and suggestions for future study are presented.

FOOTNOTES

[1]Paper presented at the Annual Meeting of the American Educational Research Association. San Francisco, California. April, 1976

[2]All presently employed by the Northwest Regional Educational Laboratory, 710 S.W. Second Avenue, Portland, Oregon 97204

[3]A more detailed explanation of the NWREL EBCE program is available by writing the Laboratory at the above address and requesting program overview materials

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